Hi Kamyar
FYI on Toss
Past History
between Jeanine
& Dennis O.C.

State of California

DEPARTMENT OF WATER RESOURCES

OFFICE MEMO

TO: Distribution List	DATE: August 4
	SUBJECT: B160
FROM: Jeanine Jones	

This memo summarizes a meeting today with Dennis O'Connor of the California Research Bureau regarding his Bulletin 160 testimony at tomorrow's Senate committee hearing on CALFED. Lucinda Chipponeri and Bulletin 160 staff met with Dennis to follow up on his review of the Bulletin's urban water use forecasts, which he had initially covered at a June hearing of Senator Johannessen's committee.

Background

Dennis plans to say that the Bulletin's urban water use forecasts could be about 1 MAF too high, based on his analysis of our data for the "Orange Detailed Analysis Unit" in the South Coast Region. The Orange DAU is one of 278 DAUs used in Bulletin 160 preparation. Dennis disagrees with the calculation used to normalize the 1995 urban base water production for that DAU. The disagreement involves the time period over which the data were normalized -- why the Department removed drought years from the data set, and the extent to which urban water use trends returned to previous levels after the 1987-92 drought. (A one-page excerpt from Bulletin 160 that describes the concept of normalizing is attached.)

Analysis

The purpose of the committee hearing tomorrow is to criticize CALFED, as indicated by the witness list (copy attached). To the extent that doubt can be cast on Bulletin 160 demand forecasts -- which are used in CALFED operations studies -- issues can be raised about the need for CALFED to implement a structural alternative. Besides Dennis, two of the other witness have criticized the Bulletin's forecasts as being too high.

From a technical perspective, we do not agree with Dennis' conclusions. He has picked one assumption and magnified it (incorrectly) far out of proportion. The Bulletin 160 base year urban water use numbers change each time a new edition of the Bulletin is prepared, reflecting a new data set. The current data set reflects the end of a drought period -- the data set for the next update will reflect other conditions. Choosing a different way to normalize urban production data in one DAU and extrapolating that change statewide as Dennis did is incorrect.

Policy Issues to Consider

Should CALFED use Bulletin 160 numbers for its demand forecasts? Although Bulletin 160 forecasts represent our best estimates for State planning purposes, CALFED is a State/federal entity. Putting the burden on CALFED to develop its own demand forecasts would change the political dynamics.

The whole argument that demand forecasts are critical to determining whether or not CALFED facilities are needed is fallacious. Bulletin 160 forecasts 2020 drought year shortages of over 6 MAF. At best it appears that CALFED could contribute 200 to 400 TAF to reducing those shortages. CALFED's new water supply contribution -- even assuming 3 MAF of storage -- is small.

Technical Responses after Committee Hearing

Policy issues aside, some points that could be made as follow-up after the hearing include:

▸ The Bulletin 160 forecasts represent the Department's best estimates of future conditions. The data used in the estimates reflect the information available at the time each update is published. The reason for updating Bulletin 160 every five years is to reflect this changing information.

▸ The Bulletin 160 updates have historically used normalized data to remove the effects of year-to-year fluctuations caused by weather conditions and abnormal crop markets. The Department seeks to forecast the future from average conditions, not from unusually wet or dry conditions.

▸ Any data set can be taken out of context and used to criticize a process. CALFED's detractors are incorrectly using Bulletin 160 information to suggest that CALFED's outcome will be flawed. California faces large drought year shortages in the future; the new water supply developed by CALFED would address only a small part of those shortages.

▸ The CRB's suggestion that Bulletin 160 urban forecasts overstate future demands by an amount similar to the volume of Folsom Reservoir is incorrect. CRB arrived at that estimate by making an analysis of 1/278ths of the State.

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Normalized Data. Water budget data used to represent the base planning year do not necessarily match the historical conditions observed in 1995. Instead, Bulletin 160-98's base year applied water budget data are developed from "normalized" water supply, land use and water use data. Through the normalizing process, year-to-year fluctuations caused by weather and market abnormalities are removed from the data. For example, water year 1998 would greatly underestimate average annual water use, as rainfall through May and early June provided the necessary moisture needed to meet crop and landscape water demands. In most years, much of California would require applied water supplies during May and early June.

On the supply side, normalized water project delivery values are computed by averaging historical delivery data. Normalized "average year" project supplies are typically computed from 3 to 5 recent non-deficient water years. Normalized "drought year" project supplies are computed by averaging historical delivery data from 1990 and 1991. A notable exception to the above procedure is the development of normalized CVP and SWP project deliveries. Supplies from these projects are developed from operations studies rather than from historical data. (See the accompanying sidebar.) Operations studies provide an average project delivery capability over a multi-year sequence of hydrology under the SWRCB's WR 95-6 Bay-Delta standards. The following section on water supply scenarios describes how other water supply data are normalized.

On the demand side, base year urban per-capita water use data are normalized to account for factors such as residual effects of the 1987-92 drought. In any given year, urban landscape and agricultural irrigation requirements will vary with precipitation, temperature, and other factors. Base year water use data are normalized to represent ETAW requirements under average and drought year water supply conditions. Land use data are also normalized. The Department collects land use data through periodic surveys; however, the entire state is not surveyed in any given year (such as 1995). To arrive at an estimate of historical statewide land use for a specific year, additional sources of data are consulted to interpolate between surveys. After a statewide historical land use base is constructed, it is evaluated to determine if it was influenced by abnormal weather or crop market conditions and is normalized to remove such influences. (See Chapter 4 for further discussion on the development of Bulletin 160-98 water and land use data.)

Normalizing allows Bulletin 160-98 to define an existing level of development (i.e. the 1995 base year) that is compatible with a forecasted level of development (i.e. the 2020 forecast year). Future year shortage calculations implicitly rely on a comparison between future water use and existing water supply, as water supplies do not change significantly (without implementation of new facilities and programs) over the planning horizon. Therefore, the normalizing procedure is necessary to provide an appropriate future year shortage calculation. Normalizing also permits more than one water supply condition to be evaluated for a given level of development. If historical data were used to define the base year, only one specific hydrologic condition would be represented. (Historical data for 1995 would represent a wet year.) But through normalizing, a base level of development can be evaluated under a range of hydrologic conditions. The following section discusses how Bulletin 160-98 develops average and drought year water supply scenarios for its water budget analysis.

CALIFORNIA LEGISLATURE

SENATE SELECT COMMITTEE ON CALFED

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Hearing on CALFED Bay-Delta Program
August 5, 1998
9:00 a.m. - 12:00 p.m.
Room 4203

Testimony of Members of the Legislature

1. Assemblyman Bernie Richter AD3

CALFED Update

1. Lester Snow, Director, CALFED

2hrs

Analysis of California's Water Supply and Demand Revisited

1. Dennis O'Connor, California Research Bureau
2. Peter Gleick, Pacific Institute For Studies in Development, Environment, and Security
3. Michael Jackson, Attorney, Regional Council of Rural Counties

Stakeholder observations of the CALFED process

BDAC Members---

1. Howard Frick, Friant Water Authority/Arvin Edison Water Supply District
2. Byron Buck, CA Urban Water Agencies
3. Eric Hasseltine, Hasseltine Best
4. Alex Hildebrand, Bay Delta Advisory Council
5. Rosemary C. Kamei, Santa Clara Valley Water District

Additional Areas of Concern...

1. Cynthia Koehler, General Counsel, Save the SF Bay/Environmental Water Caucus
2. David Brown, Manager, Sacramento-Yolo Mosquito & Vector Control District
3. Alan Clarke, Executive Director, Northern California Marine Association
4. Other NCMA members possible as time permits.

Statement of Dennis O'Connor,
Assistant Director, California Research Bureau
Presented To The
Senate Select Committee On CalFed Water Program
August 5, 1998

Chairman Johannessen, Members, for the record I am Dennis O'Connor, Assistant Director for Environment and Natural Resources for the California Research Bureau.

Mr. Chairman, on June 9, 1998, I testified before this committee on how DWR projected urban water demand through the year 2020. I described how DWR used a two-step process. That is, first they forecast urban per capita daily consumption. They then multiply that forecast by the Department of Finance's population forecast.

I then described how DWR forecasts per capita daily consumption. Briefly, DWR first establishes base year consumption, and then forecasts changes to per capita consumption based on expected socio-economic effects and conservation efforts.

Then I explained that DWR establishes base year consumption by examining the historical pattern of water use and adjusts for hydrologic conditions.

Finally, I showed the Committee a chart showing historic urban water demand and DWR's estimated base year consumption. I have attached a slightly reformatted version of that chart, labeled Chart 1, to my printed testimony.

This chart shows a gap of about 60 gallons per capita daily (gpcd) between historic water consumption and DWR's 1995 estimate of average year demand.

While DWR agreed with my description of its methodology, DWR strongly disagreed with the chart. In their view, the chart made an apples-to-oranges comparison that did not properly reflect the relationship between historic urban water demand and DWR's 1995 estimate.

Since June, DWR has been very accommodating in trying to resolve this issue. We have had numerous meetings, telephone calls, e-mails etc., and they have provided me with the necessary data sets. The result of my research is:

There is still a gap between DWR's 1995 base year estimate and historic demand, although it is not as large as I originally thought it was.

There are three reasons why the chart shown on June 9, 1998 showed such a large gap between historic urban water use and the 1995 base year demand.

1. *DWR mis-labeled a key chart in both the current draft Bulletin 160-98* AND *the previous final version of Bulletin 160-93.*

In both the draft Bulletin 160-98 and the final Bulletin 160-93, DWR included a chart labeled "Urban per Capita Water Use." In draft Bulletin 160-93, DWR labeled the vertical axis "gallons per capita daily." However, in the final Bulletin 160-93, DWR labeled the vertical axis "Urban Applied

Water Use (gallons per capita daily)". Moreover, the text described the chart as urban applied water use. So naturally, I used the chart from the draft Bulletin 160-98 as the source for the historic urban applied water us shown in Chart 1.

However, discussions with DWR revealed that the chart in fact did not show urban applied water use. The chart actually showed urban municipal and industrial production (also known as urban M&I production).

Urban M&I production is one of two components of urban applied water. It represents the water urban water agencies put into their system for deliveries to their customers. The other component of urban applied water is self-supplied water. This is the urban water supplied by private wells. For some regions, like southern California, self-supplied water is a rather insignificant part urban applied water. However, in areas like the San Joaquin Valley where there are a number of canneries, etc., that get their water from their own private wells, self-supplied water is very important.

Consequently, Chart 1 understates historic urban water use by the amount of self-supplied water. Statewide, self-supplied water accounts for about eight gpcd. The consequence of DWR's mis-labeling of the chart in Bulletin 160, then, is that we can account for about eight of the 60 gpcd discrepancy shown on Chart 1.

2. *DWR changed how it accounted for water in the draft Bulletin 160-98, and did not describe the change in the text*

In the previous Bulletin 160-93, as with all prior editions of Bulletin 160, DWR used four categories of water use: Urban, Agriculture, Environment, and Other. Other included major conveyance facility losses, recreation uses, and energy production.

However, in the current draft Bulletin 160-98, DWR used three categories of water use: Urban, Agriculture, and Environment. DWR spread Other water use across the remaining three water use categories. This means that the table in draft Bulletin 160-98 labeled "Urban Applied Water" actually included urban applied water *plus* a portion of Other. However, nowhere in draft Bulletin 160-98 did DWR discuss this break with tradition.

Consequently, Chart 1 understates historic urban water use by the amount of attributed to Other water. Statewide, the Other water DWR attributed to urban water use is about 16 gpcd. So, the consequence of DWR's undocumented change in accounting is that we can account for another 16 of the 60-gpcd discrepancy shown on Chart 1.

Now, in all fairness to DWR, part of the reason for releasing a draft version of a report is to help identify these kinds of oversights. Moreover, correcting for these two errors puts us back to an apples-to-apples comparison. Chart 2 shows how these two corrections account for about 24 gpcd, or about 40 percent of the gap between historic urban M&I production and DWR's 1995 base.

3. DWR's "normalization" process overstates baseline consumption

The purpose of normalization is to remove the year to year fluctuations in demand due to annual changes in hydrologic patterns.

To do so, DWR divides the state first into major hydrologic regions. It then divides each hydrologic region into planning sub-areas and then further divides the planning sub-areas into detailed analysis units or DAUs. For illustrative purposes, I will focus on the South Coast Hydrologic Region and DAU 96 – Orange. (See Chart 3.)

For each DAU, DWR uses production data from select "representative agencies" as the basis for its normalization. For DAU 96, the agencies are: Anaheim, Buena Park, Costa Mesa, Fullerton, Garden Grove, Huntington Beach, Orange, Laguna Beach, and Santa Ana.

To establish the normalized 1995 demand, DWR did not want to use production from the five-year drought nor the first couple of years after the drought. This is because after the 1976-77 drought, demand quickly rebounded to its pre-drought level. (See Chart 4.) So, to establish the 1995 normalized demand, DWR extrapolated the 1980 to 1988 trend in urban M&I production to 1995. They then adjusted the estimate down slightly to adjust for the beginning of the Urban BMPs (Best Management Practices) which were designed to increase the level of urban water conservation and thereby reduce demand.

The key assumption behind this approach is that trends in people's water use habits and practices that existed in 1980-1988 would continue on to 1995 as if the drought never occurred. That is, beyond some minor changes from toilet retrofits, etc., the five-year drought experience did not induce people to permanently change how they used water.

The data suggest otherwise. Chart 5 shows actual M&I production for the Orange DAU through 1995. The chart shows that actual production appears to have stabilized at a new lower level. The difference between the "Normalized" 1995 and actual production in 1995 is 30 gpcd, or about 47,000 acre-feet per year.

The Orange DAU is not unique. Virtually all south coast cities show similar water use patterns. DWR does not have complete data through 1995 on urban M&I production for all representative cities in the south coast hydrologic region. So, I combined the data for those cities for which DWR does have a full data set. The cities are: Anaheim, Banning, Downey, Fullerton, Inglewood, Los Angeles, Manhattan Beach, Orange, Pasadena, Redlands, Santa Ana, and Santa Monica. These cities have a combined population of just over 5 million, or about 1/3 of the south coast hydrologic region.

As shown in Chart 6, urban M&I production in the south coast does not appear to be returning its pre-drought trend. That is, the 1987-92 drought appears to have permanently changed how people in southern California use water.

More recent data further support this observation. The City of Los Angeles, in its *Urban Water Management Plan* for fiscal year 1996-97 observes, "Water use in Los Angeles increased by about 2 percent from the previous fiscal year.... The slight jump in sales can be attributed mainly to population growth, as citywide water conservation levels remain solid at 20 percent."*

Assuming the water use patterns shown in the previous charts apply statewide, the balance of the gap can be explained by DWR's normalization process. (See Chart 7.) DWR's normalized 1995 M&I production estimates appear to be overstated by about 15 percent. That works out to approximately 1.2 million acre-feet, or 20 percent more than the reservoir holding capacity of Folsom Dam.

There are technical issues with DWR's normalization approach as well.

Perhaps the most important has to do with how DWR selects the "representative" agencies for the DAUs. DWR tries to select agencies that best represent the water use of the DAU. Sometimes, like with the Orange DAU, it is easy – there are a number of agencies able and willing to provide the necessary data.

However, it is not always easy to find representative agencies for given DAUs. Take, for example, DAU 90 – San Fernando. The City of Los

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* City of Los Angeles, *Urban Water Management Plan: Annual Update Report*, Fiscal Year 1996-97, http://www.dwp.ci.la.ca.us/water/supply/uwmplan/

Angeles provides water to most of the DAU. However, DWR attributes all of Los Angeles's water use to DAU 89 – Coastal. That means two things. First, water use patterns in the Coastal DAU are skewed (probably upwards) by water use patterns in the San Fernando Valley. Second, it means that there are not any agencies well suited to represent water use in the San Fernando Valley.

DWR's solution is to use representative agencies from outside of the DAU. For the San Fernando Valley, DWR used San Gabriel Valley cities. For both the North Riverside and South Riverside DAUs (DAUs 100 & 104), DWR used the same four cities: Banning, Corona, Hemet, and Riverside. For the Temecula DAU (DAU 110), DWR used Corona, Hemet, and Escondido.

There is a potentially serious problem with this approach. While it is possible that water use in these areas show similar *patterns*, it seems unlikely that the absolute level of per capita water demand in these areas are the same. Riverside and Corona have different micro-climates than Banning and Hemet. Different cities have different mixes of businesses and industries. Family income and other socio-economic factors differ. And most important, different water agencies sell water at different prices and under different water conservation regulations.

These differences might or might not be important. What is important is that all interested parties agree that DWR has taken the best approach to estimating baseline demand – and on this point, there is no consensus.

Why is this important?

As I testified last June, DWR forecasts 2020 demand based on projected changes to this base. If the base is too high, the 2020 demand forecast is too high.

Moreover, CalFed is using these year 2020 forecasts for their alternative's analysis. If CalFed is trying to meet an overstated demand, they will exclude otherwise viable options because they cannot meet the overstated demand.

Finally, a small error can generate a lot of water. A difference of 10 gpcd is equal to 360,000 acre-feet per year, the capacity Hetch Hetchy. A difference of 1 million people (which is less than the amount DOF revised its year 2000 population forecast between its official 1993 and its 1997 interim forecast) is equivalent to 224,000 acre-feet a year, – a bit more than capacity of Pardee Reservoir.

Conclusions

In conclusion, I have two recommendations and a comment.

1. ***DWR needs to describe much more explicitly the hows and whys of its urban demand estimates in Bulletin 160-98.***

To its credit, DWR recognizes that there is a problem with their draft Bulletin 160-98 and is working to correct and clarify both the text and the supporting tables and charts.

2. DWR needs to revisit its normalization methodology.

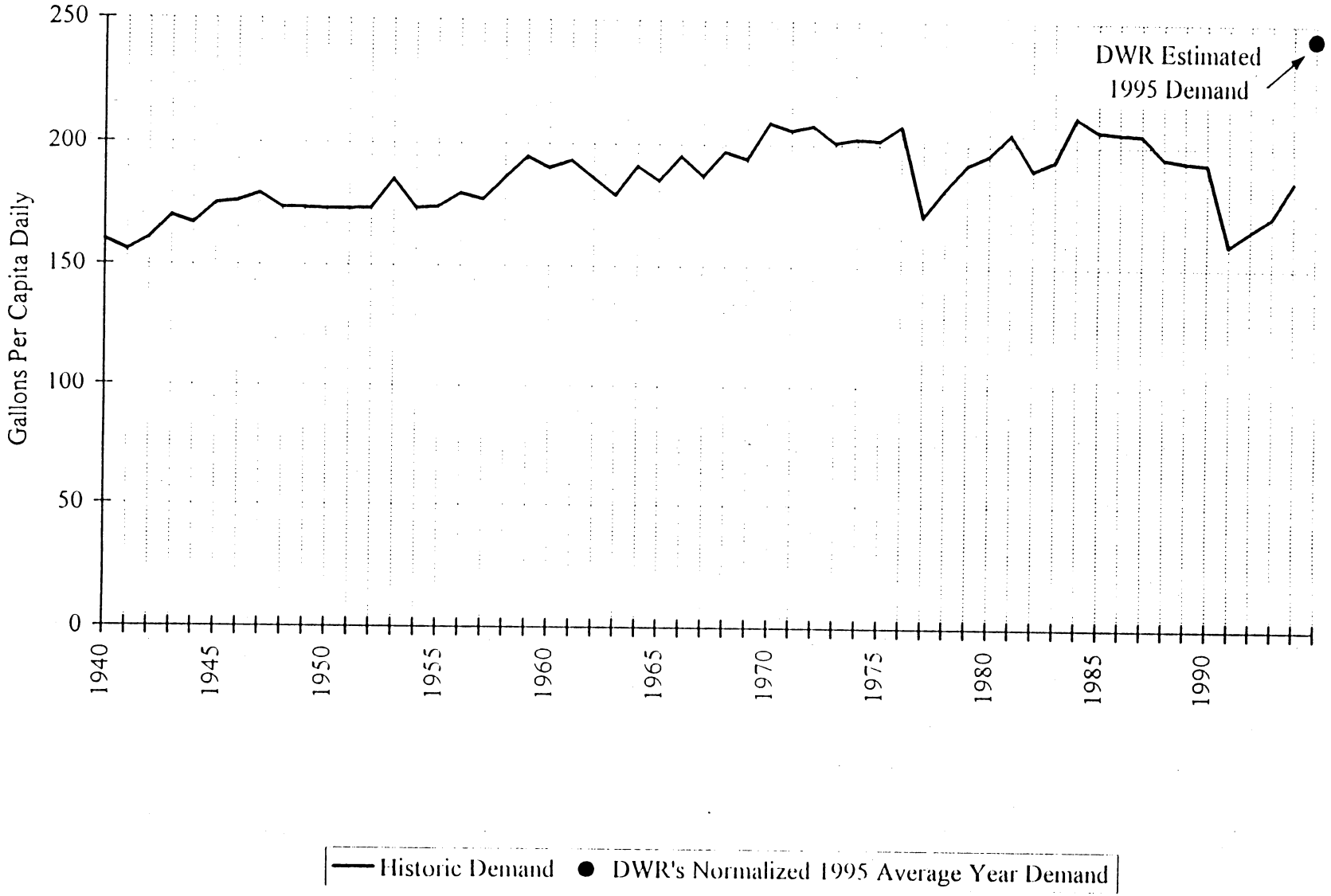
As you might imagine, my testimony last June generated a lot of interest within the water world. Hallway discussions suggest that people on all ends of the water spectrum are uncomfortable with using 1980-1988 trends to set 1995 base conditions. This is especially true since actual trends differ greatly from DWR's 1995 base.

Comment

As I noted in June, if the CalFed alternative is to meet the solution principles (implementable, affordable, durable, etc.) it is important that the underlying forecasts be as accurate as possible. What I neglected to mention, is that it is just as critical that all involved in the CalFed process feel comfortable with the forecasts' accuracy as well. This is a key assurance issue. Both accuracy and the perception of accuracy are equally important.

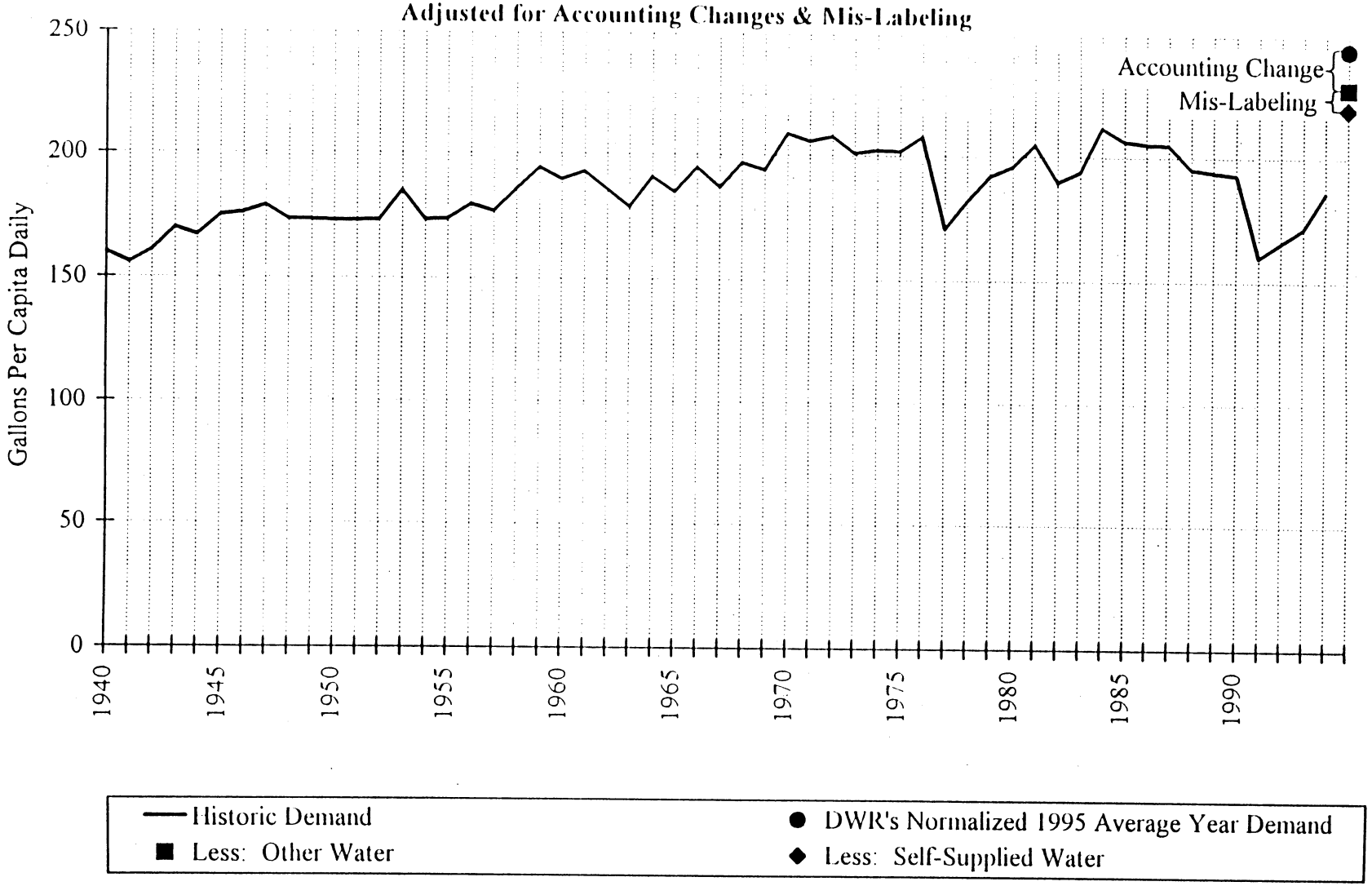
I will be happy to answer any question.

Chart 1
Urban Water Consumption -- Historical Demand and DWR's Estimated Base Year



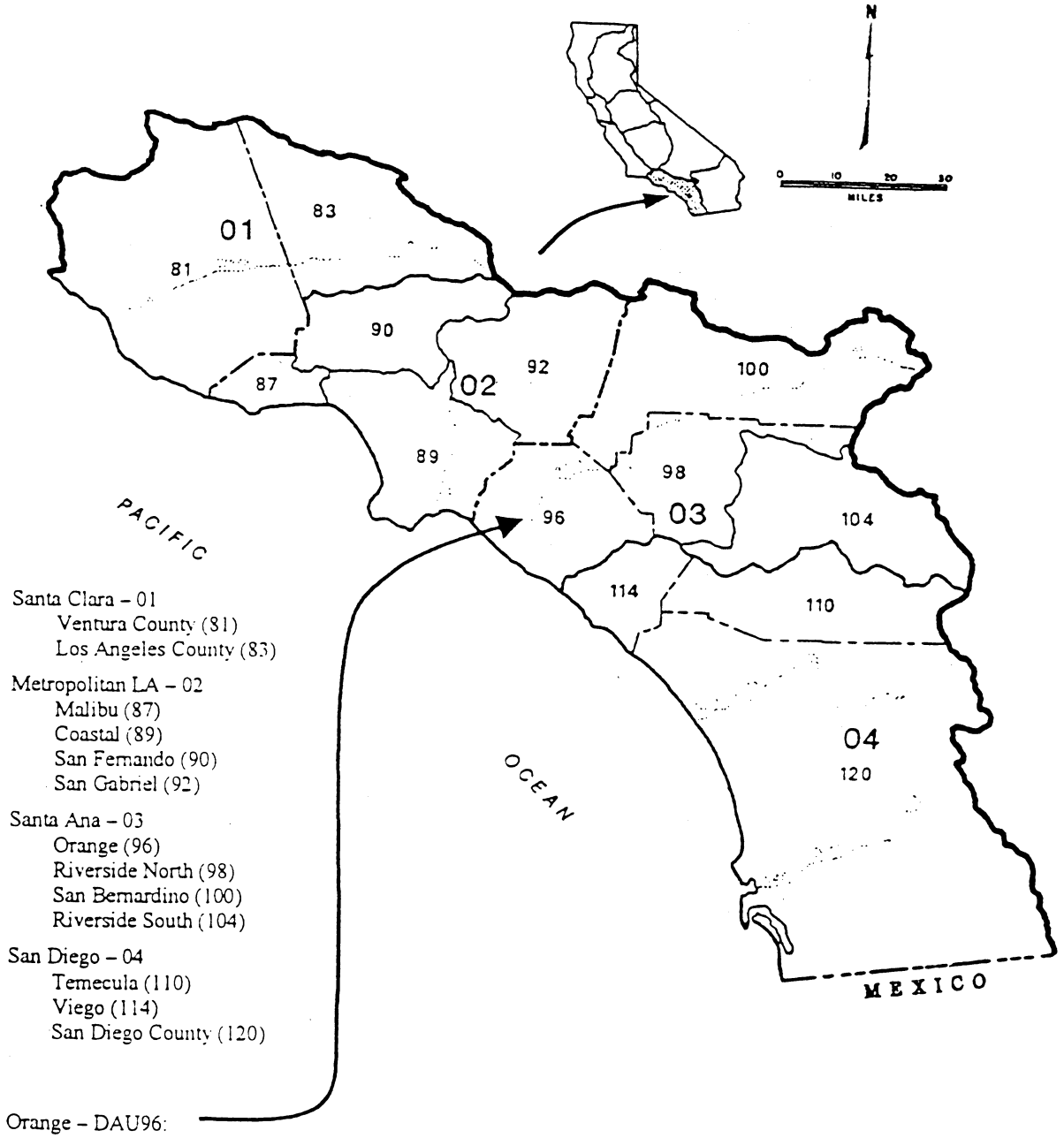
Sources: DWR
Bulletin 160 Figure 4-5 and Table 4-10

Chart 2
DWR's Normalized 1995 Average Year Demand
Adjusted for Accounting Changes & Mis-Labeling



Sources: DWR data, CRB analysis
Bulletin 160 Figure 4-5 and Table 4-10, DWR Staff

Chart 3
South Coast Hydrologic Region
Planning Sub-Areas and Detailed Analysis Units



Santa Clara – 01
- Ventura County (81)
- Los Angeles County (83)

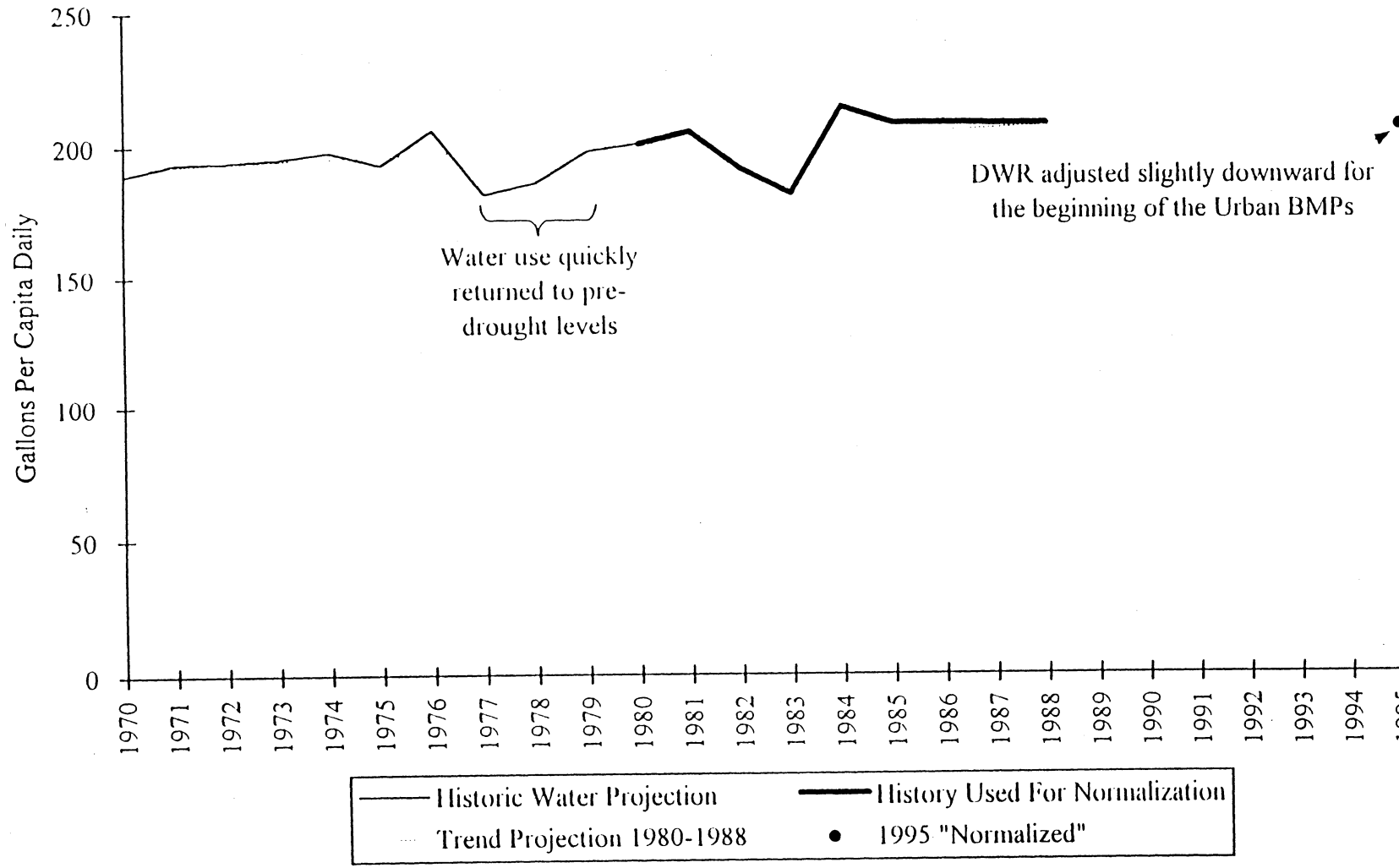
Metropolitan LA – 02
- Malibu (87)
- Coastal (89)
- San Fernando (90)
- San Gabriel (92)

Santa Ana – 03
- Orange (96)
- Riverside North (98)
- San Bernardino (100)
- Riverside South (104)

San Diego – 04
- Temecula (110)
- Viego (114)
- San Diego County (120)

Orange – DAU96:
- Anaheim
- Buena Park
- Costa Mesa
- Fullerton
- Garden Grove
- Huntington Beach
- Orange
- Laguna Beach
- Santa Ana

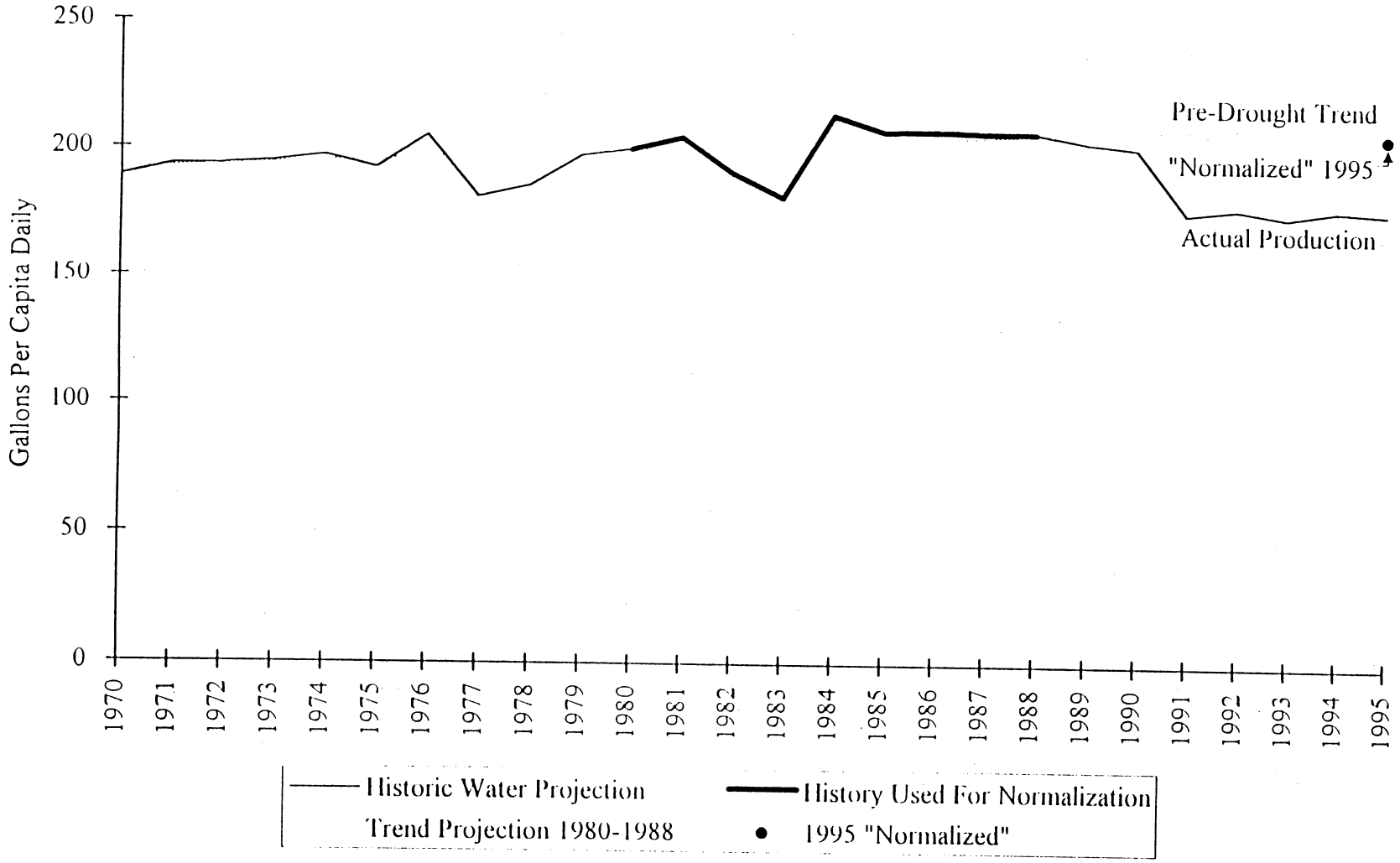
Chart 4
DWR "Normalized" 1995 Urban Water Production
Based On 1980 - 1988 Trend



Source: DWR
Urban Water Production: Orange DAU

Anaheim, Buena Park, Costa Mesa, Fullerton, Garden Grove, Huntington Beach, Laguna Beach, Orange, Santa Ana

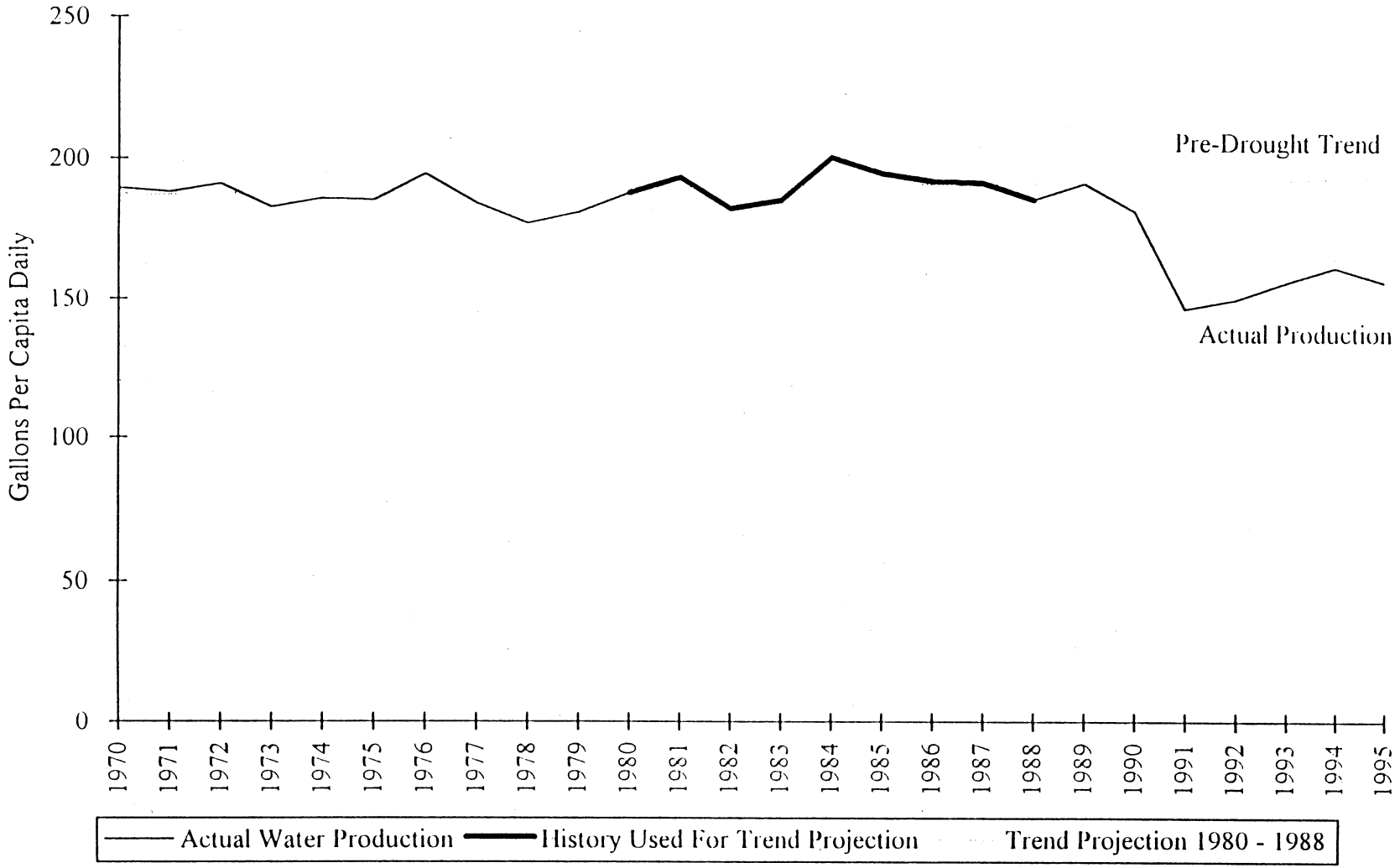
Chart 5
Urban Water Use In Orange DAU
Has Not Returned To Pre-Drought Levels



Source: DWR
Urban Water production: Orange DAU

Anaheim, Buena Park, Costa Mesa, Fullerton, Garden Grove,
Huntington Beach, Laguna Beach, Orange, Santa Ana

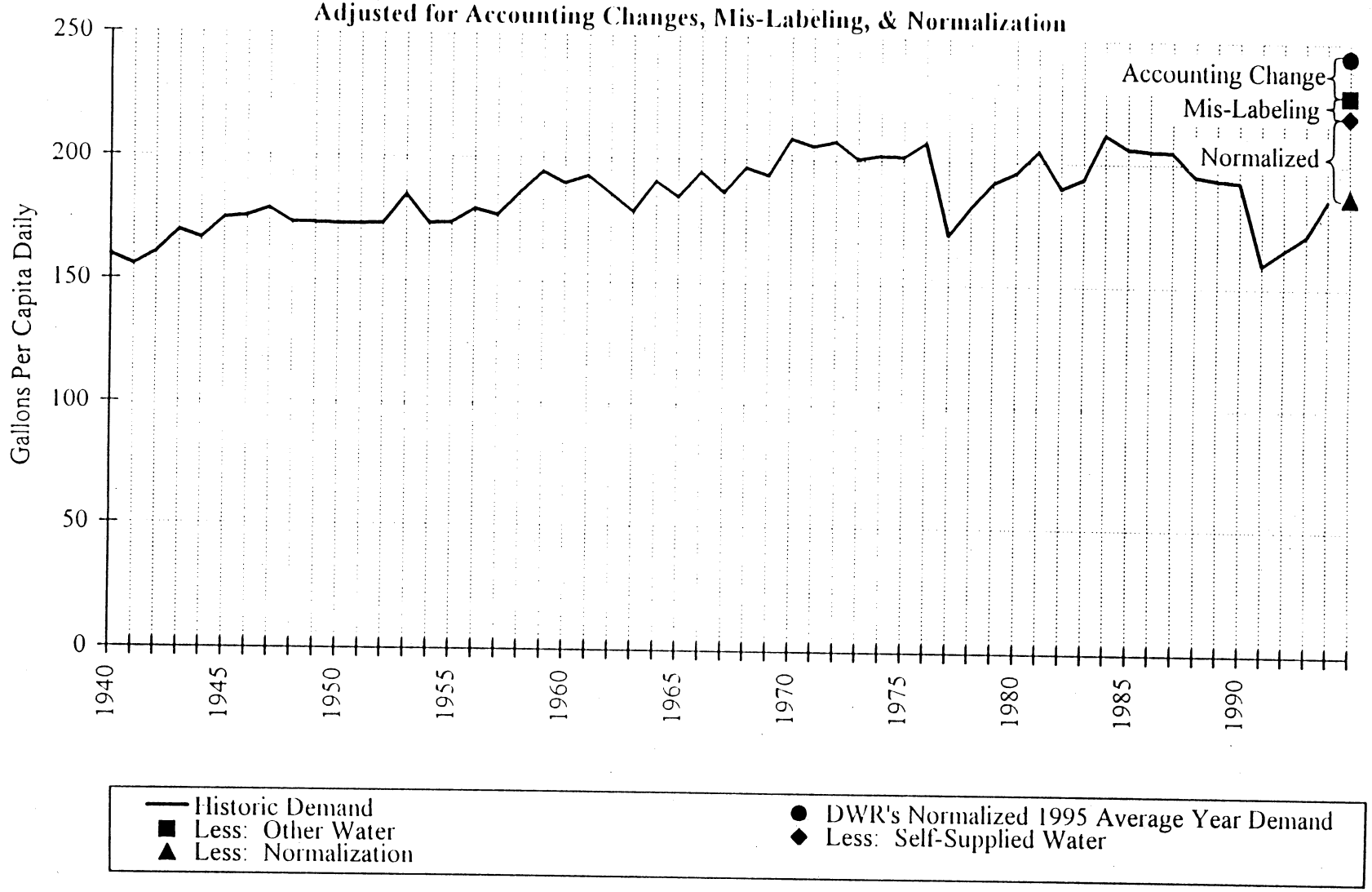
Chart 6
There Is No Evidence That Urban Water Production In the South Coast Hydrologic Region Is Returning to Pre-Drought Levels



Urban Water Production, South Coast Hydrologic Region,
Cities for which DWR has complete data, 1970 - 1995

Anaheim, Banning, Downey, Fullerton, Inglewood, Los Angeles,
Manhattan Beach, Orange, Pasadena, Redlands, Santa Ana, Santa Monica

Chart 7
DWR's Normalized 1995 Average Year Demand
Adjusted for Accounting Changes, Mis-Labeling, & Normalization



Sources: DWR data, CRB analysis
Bulletin 160 Figure 4-5 and Table 4-10; DWR Staff

State of California | The Resources Agency

DEPARTMENT OF WATER RESOURCES

OFFICE MEMO

TO: Distribution List	DATE: July 1, 1998
	SUBJECT: CRB Data Requests
FROM: Jeanine Jones	

As requested, this memo summarizes our interactions with Dennis O'Connor of the California Research Bureau on CRB's requests for Bulletin 160 urban water use data.

Background

O'Connor made a presentation on Bulletin 160 water use forecasts at the June 9th hearing of the Senate Select Committee on CALFED. His main point was that the Bulletin's forecasted 2020 urban water demands were too high, thus casting doubts on CALFED's use of Bulletin 160 data relative to the CALFED alternative analysis.

In his presentation, O'Connor correctly summarized the Bulletin 160 forecasting process, but used the wrong information from the Bulletin to arrive at his conclusion. His analysis was based on urban water production data shown in the public draft of Bulletin 160-98. [As he pointed out when we met with him, both Bulletin 160-93 and the public draft of Bulletin 160-98 incorrectly labelled the urban water production data graphed in the documents as urban water use data.] His analysis did not reflect two factors -- the "other" component of urban water use in addition to urban water production, and the normalizing process used for Bulletin 160 base year (1995) data.

Bulletin 160 urban water use is composed of urban water production (water supplied by local agencies, obtained from DWR's annual surveys of public water agencies), self-supplied industrial water, conveyance system losses, recreation water use, and water use for energy production (e.g., cooling water).

For Bulletin 160 base year water use, all categories of water use -- urban, agricultural, and environmental -- are normalized to remove the influence of droughts or wet years, unusual agricultural markets, etc. Thus, actual historical urban production data collected in DWR's survey are used to calculate the normalized 1995 base year data in Bulletin 160. (Normalizing entails picking a time period, removing the hydrologically abnormal years, and fitting a line through the remaining data points.) Normalized production data are calculated at Bulletin 160's detailed analysis unit level, from a representative selection of agencies responding to the public water system survey. Bulletin 160 urban water use forecasts are then made by aggregating calculations at a DAU level to the hydrologic region level, and then to a statewide level.

Since O'Connor's presentation to the Committee did not account for the other categories of urban water use in addition to local agency water production and the effect of normalizing, he concluded that the Bulletin's 1995 base year demand was too high.

Meetings with O'Connor in Response to Committee Hearing

We met with him on June 12th, to go over the water production/total water use point and the reason for normalizing Bulletin 160 data. He requested data that he could use to check information presented in the Bulletin, and was interested in South Coast hydrologic region sample calculations. We met again on June 22nd to provide him with a variety of information (meeting agenda and summary handout with sample calculations attached). At that meeting, we provided him with copies of the public water system surveys results (summarized in Bulletin 166-3 and 166-4, plus additional tabulated survey data to update a sample DAU through 1995), copies of Bulletin 160 annual data reports from 1988-1994 (showing how other components of urban water use are added to urban water production), South Coast region water budget data, and pending revisions to Chapter 4 of Bulletin 160-98 (showing how the urban water use section was rewritten to clarify the calculations).

O'Connor called on the 26th and requested more data. He now appears to be reviewing how normalized 1995 data were calculated for each DAU in the South Coast region. We have sent him 15 years of water production data for about 100 water agencies in the region, and are in the process of compiling the data by DAU (at his request) in a format that will make it easier for him to manipulate.

To date, responding to O'Connor's data requests has required about 2.5 staff-weeks of time, correspondingly delaying production of Chapter 4 of the Bulletin.

Attachments

Distribution List
Dave Kennedy
Lucinda Chippponeri
Ray Hart
Bob Potter
Bill Bennett

BULLETIN 160-98

URBAN WATER USE

6/22/98

1. Difference between collected (actual) local water agency water production data and Bulletin 160 calculated M&I water use for water budgets.

   ▸ DWR collects urban production data annually. These data are a component of Bulletin 160 information, but are useful in their own right for evaluating trends.

   ▸ Bulletin 160 calculated M&I water use is only needed once every five years, for base year in Bulletin. Since 1988, however, DWR "Annual Reports" have been prepared for water budget calculations. These annual reports, internal documents done for District staff training purposes, illustrate how urban water use is computed.

   ▸ Bulletin 160-98 total urban applied water use (either in TAF or per capita) includes "other" component

   ▸ Bulletin 160 base year data are normalized.

2. Historical data trends (handouts)

3. Revisions in progress to public review draft of Bulletin 160-98.

4. How can we best package this information for CRB?

How Does DWR Establish Base Year Urban Applied Water Demand?

Background - Collection of actual (measured) water production data

Public Water System Statistics Survey ("urban water production survey")

- annual survey data on urban water agency production, 1940 to present
- number of respondents has ranged from about 300 (during 1980s) to over 450 currently
- serves as one source of raw data for calculating applied water demands
- historical survey data published and summarized in Bulletin 166 series
- survey data, expressed as per capita based on agency reported population, are summarized by hydrologic region and statewide to show gross trends in urban water use
- summarized data are not used to calculate applied water demand

Bulletin 160 - Calculation of total urban water use data

Annual Water Use – Water Supply Budgets ("annual reports")

- historical data on California population, land use, water use, surface water supply, and groundwater
- urban water demand is calculated for each detailed analysis unit
- annual urban applied water demand includes urban water production (M&I), recreation use, energy plant cooling use, and self-supplied high water using industry use.
- data are derived from multiple sources including water production survey data, water agency records, and self-supplied industrial water users
- annual urban applied water demand forms the basis for Bulletin 160 base applied water demand

South Coast Hydrologic Region Actual Urban Applied Water Demand and Population, 1988-94

	1988	1989	1990	1991	1992	1993	1994
Urban Applied Water Demand (TAF)							
M & I	3,320	3,695	3,568	2,981	3,148	3,203	3,454
Rec	8	6	6	6	6	6	6
Cooling	8	8	8	8	8	8	8
HWUI	19	20	20	20	20	20	20
TOTAL	3,355	3,729	3,602	3,015	3,182	3,237	3,488
Population (1,000)	15,459	15,820	16,293	16,589	16,889	17,092	17,252
Urban Applied Water Demand (GPCD)	194	210	197	162	168	169	181

Bulletin 160 - Adjust for Hydrologic Conditions

Normalized Base Year Data

- Bulletin 160 water budgets are based on normalized land use, water use, and water supply data
- Normalizing removes the effects of year to year fluctuations in actual water use and supply data caused by weather and market abnormalities that would otherwise bias the forecast

Bulletin 160 - Method Used to Calculate 1995 Base Applied Water Demand

- Normal year urban applied water demand is computed for each detailed analysis unit
- Water supply and demand balances are computed at the DAU (or PSA) level
- Hydrologic region summaries are for display purposes
- South Coast Hydrologic Region example - Orange Detailed Analysis Unit (DAU 96)

Orange Detailed Analysis Unit 1995 Base Applied M & I Water Demand (normalized)

City	Population	Production (gpcd)
Anaheim	296,497	249
Buena Park	72,000	215
Costa Mesa	113,985	194
Fullerton	122,059	238
Garden Grove	153,824	188
Huntington Beach	192,000	199
Orange	122,080	241
Laguna Beach	23,000	185
Santa Ana	311,742	159
Weighted Average		207

1995 Base Applied M & I Water Demand – South Coast Hydrologic Region (normalized)

DAU Name	DAU No.	Population	Applied Water Demand (taf)	(gpcd)
Ventura County	81	712,460	152	191
Los Angeles Co	83	209,300	54	229
Malibu	87	75,700	15	178
Coastal	89	5,352,800	1,067	178
San Fernando	90	1,703,500	403	211
San Gabriel	92	1,714,400	455	237
Orange	96	2,219,800	515	207
Riverside North	98	527,300	145	245
San Bernardino	100	1,192,900	383	287
Riverside South	104	409,400	113	246
Temecula	110	121,600	29	214
Viego	114	395,000	95	215
San Diego Co	120	2,664,700	606	203
South Coast Region		17,298,860	4,032	208

1 Data shown does not include 308 taf of "other" demands to allow for direct comparison previous Bulletin 160 data. Previous editions of the Bulletin treated "other" demands, including losses from major conveyance facilities and energy plant cooling use, as a separate category of water use.

Comparison of Calculated Bulletin 160 Base Years Over Time

Bulletin 160 Base Year Urban Applied Water Demand Since 1950 - South Coast Hydrologic Region

Bulletin	Base Year	Population (1,000)	Urban Applied Water Demand (taf)	(gpcd)
160-98[1]	1995	17,300	4,032	208
160-93	1990	16,300	3,851	211
160-87	1985	12,900	2,780	192
160-83	1980	12,969	2,777	191
160-74	1972	11,240	2,370	188
160-70	1967	10,510	2,060	175
160-66	1960	8,551	1,640	171
2 & 3	1950	5,388	885	147

1 Data shown does not include 308 taf of "other" demands to allow for direct comparison previous Bulletin 160 data. Previous editions of the Bulletin treated "other" demands, including losses from major conveyance facilities and energy plant cooling use, as a separate category of water use.

Bulletin 160 Base Year Urban Applied Water Demand Since 1950 - California

Bulletin	Base Year	Population (1,000)	Urban Applied Water Demand (taf)	(gpcd)
160-98[2]	1995	32,100	8,206	228
160-93	1990	30,000	7,800	232
160-87	1985	26,100	6,590	225
160-83	1980	23,773	5,762	216
160-74	1972	20,500	5,040	220
160-70	1967	19,100	4,380	205
160-66	1960	15,717	3,257	185
2 & 3	1950	10,590	1,656	140

2 Data shown does not include 567 taf of "other" demands to allow for direct comparison previous Bulletin 160 data. Previous editions of the Bulletin treated "other" demands, including losses from major conveyance facilities and energy plant cooling use, as a separate category of water use.